6th Semester		Micro Electronic Mechanical Systems	L-T-P 3-0-0	3 CREDITS

Course Outcome:

- Students will explain MEMS Technology, Present, Future and Challenges.
- Students will be able to explain micro sensors, micro actuators, their type and application

Module-I: **(12 hours)**

Introduction and Emergence of MEMS, Scaling issues, materials for MEMS, Thin film deposition, Photolithography, doping, wet and dry etching

Micromachining Techniques: Surface and Bulk micro machining, wafer bonding, surface micro machining and LIGA process, Silicon as material for micromachining, (Chapter 3 and Section 8.2 of Book 1, Chapter 2 of Book 2)

Module-II: **(12 hours)**

MEMS devices, Engineering Mechanics for Micro System Modeling and Design – static bending of thin plates, Mechanical vibrational analysis, Thermo mechanical analysis,fracture mechanics analysis, thin film mechanics, Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage, Theory and design: Micro Pressure Sensor, micro accelerometer – capacitive and piezoresistive, micro actuator.(Section 4.1 to 4.3 and 6.2.2 of Book 1, Section 3.4 of Book 2)

Module-III: **(12 hours)**

MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, OpticalGyroscopes: Micro-lens, Micro-mirror, Optical Switch Radiofrequency MEMS:Inductor, Varactor, Filter, Resonator.

Microfluidics: Capillary action, Micro pumping, Electro wetting, Lab-on-a-chip.

Electronic interfaces, design, simulation and layout of MEMS devices using CAD tools.(Section 10.1to 10.8 of Book 2)

Books:

[1] G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.

[2] N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.

[3] T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

[4] Gabriel M. Rebeiz: RF MEMS Theory, design &Technology, Wiley India Education,2010.

Digital Learning Resources:

Course Name: MEMS and Microsystems
Course Link: https://nptel.ac.in/courses/117/105/117105082/